UNCOMPACTED VOID CONTENT OF FINE AGGREGATE

AASHTO T 304

GLOSSARY

Voids - Difference between the total volume and the volume occupied only by the aggregate particles. The amount of void space (or air space) is a function of the aggregate gradation, particle shape and texture, and the amount of compaction of the material.

Uncompacted Voids - The amount of void space present when the material is in an uncompacted, unconsolidated state.

Bulk Dry Specific Gravity - The ratio of the weight in air of a unit volume of aggregate at a stated temperature to the weight in air of an equal volume of gas-free distilled water at the stated temperature.

Angularity - A description of the degree of roughness, surface irregularities or sharp angles of the aggregate particles (i.e. particle shape).

SCOPE

This method determines the loose uncompacted void content of a sample of fine aggregate. When performed on an aggregate sample of a known, standard grading (Method A), this measurement provides an indication of particle shape. The material angularity, roundness or surface texture relative to other materials of the same standard grading is indicated by the percent of voids determined by this test. The Superpave asphalt mix design method sets minimum requirements for void content that vary depending on traffic loads and depth from the surface of the asphaltic concrete pavement.

In this method, the prepared sample is allowed to free-fall through a standard funnel of a specified diameter from a specified height into a small cylinder of known volume (nominal 100 mL). The material is then leveled with the top of the calibrated cylinder and weighed. Because the volume and weight of the cylinder are known, the weight of the sample contained in the cylinder can be calculated. Using the Bulk Dry Specific Gravity (as determined by AASHTO T 84), the volume of the material in the cylinder is calculated. By subtracting the calculated volume of material from the calibrated volume of the test cylinder, the volume of voids can be calculated.

SUMMARY OF TEST

A sample of sand is prepared in accordance with one of three methods. Method A, a standard gradation, is the most common used. The sample is allowed to free-fall from a funnel into a cylinder of known volume. Using the Bulk Dry Specific Gravity of the sample as determined by AASHTO T 84, the percent of void space in the cylinder is calculated. This value is known as the Fine Aggregate Angularity Value or FAA.

Apparatus

Cylindrical measure, approximately 1.56 in. (39 mm)in diameter, 3.44 in. (86 mm) deep with a capacity of approximately 100 mL.

Funnel, conforming to figure 2 in AASHTO T 304.

Funnel Stand, conforming to figure 2 in AASHTO T 304.

Glass Plate, for calibrating cylindrical measure.

Pan, large enough to contain funnel stand and to catch overflow material.

Metal spatula, with a straight edge approximately 4.0 in. (100 mm) long and 0.8 in. (20 mm) wide.

Balance, accurate and readable to 0.1 grams.

Procedure - Only Method A will be discussed in this procedure. For other methods consult AASHTO T 304

1. Wash representative sample in accordance with T 11. The size of this sample is dependent on the gradation of the sample. Generally 500 grams to 700 grams is sufficient to yield the necessary size fraction quantities.

2. Dry washed sample material in a 230 ± 9°F (110 ± 5°C) oven to a constant weight.

   Sieve material in accordance with AASHTO T 27. Remove the following size fractions from the sieves and retain in separate, labeled containers:

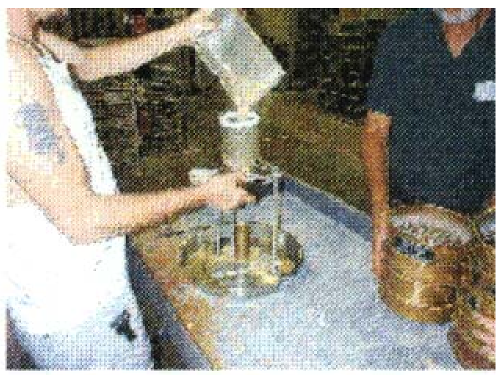
   Passing No. 8 (2.36 mm) - Retained on No. 16 (1.18 mm)
   Passing No. 16 (1.18 mm) - Retained on No. 30 (600 µm)
   Passing No. 30 (600 µm) - Retained on No. 50 (300 µm)
   Passing No. 50 (300 µm) - Retained on No. 100 (159 µm)

3. Weigh individual size fractions and combine them in accordance with the following:

Size Fraction		Weight, grams
No. 8 (2.36 mm)	x No. 16 (1.18 mm)	44
No. 16 (1.18 mm)	x No. 30 (600 µm)	57
No. 30 (600 µm)	x No. 50 (300 µm)	72
No. 50 (300 µm)	x No. 100 (150 µm)	17
	Total	**190**

4. Mix combined sample thoroughly with spatula.

5. Place finger under opening in funnel to seal opening. Pour mixed sample into funnel.



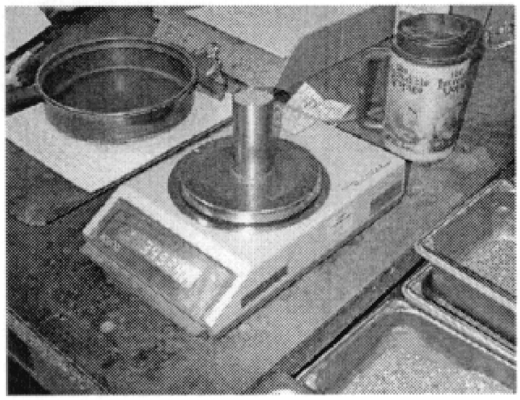
Pouring sample into funnel

6. Quickly remove finger from funnel and allow sample to free-fall into the calibrated cylinder.

7. Take care not to vibrate or unnecessarily disturb the material in the cylinder to avoid further consolidation. Strike off the excess material above the lip of the cylinder with the spatula edge, held in a vertical position, using one continuous motion.

8. After striking off, remove any excess sand from the outside of the cylinder using a small brush. At this point, additional compaction of the material in the cylinder will not affect the test results and will aid in handling.

9. Weigh the cylinder with the sample and record to the nearest 0.1 grams. Retain and recombine all materials for the next trial.



Weighing the Cylinder

10. Repeat test using recombined sample. Calculate and report the average of at least two trials.

Calculations

Calculate the uncompacted voids content as follows:

$$U = \frac{V-(F/G)}{V} \times 100$$

Where:

V = Volume of calibrated cylinder in mL (cubic centimeters)

F = Net Weight of Sample in cylinder (Gross weight minus weight of empty cylinder)

G = Bulk Dry Specific Gravity as determined by AASHTO T 84

U = Uncompacted Voids in Percent (reported to nearest 0.1%)

Example:

Volume of Cylinder: 99.92 mL

F = 156.4 gm.

G = 2.643

$$U = \frac{99.92 - (156.4 \text{ gm.} / 2.643)}{99.92} \times 100 = 40.8$$